C5-SERIES
SUBWOOFER MANUAL

Thanks for buying our product! Product information follows; please read it carefully to get the most out of your subwoofers. Any questions, you can contact technical support:
Phone 972-570-0800; Email: tech@crossfirecaraudio.com

Enjoy!

Subwoofer Power Rating:
Power handling for subwoofers depends on the conditions used. How loudly you play, what type of music and how hard you drive the amplifier are more important than any numbers-but of course, some kind of numeric guideline is necessary for convenience. Therefore, Crossfire rates as follows:

Nominal Power Handling: This amount of RMS amplifier power should not cause damage to a subwoofer in a recommended enclosure-so long as the amplifier is not clipped.*

Maximum Power Handling: This amount of RMS amplifier power driving the subwoofer at maximum volume continuously could cause damage over time and should be used with caution and without clipping the amp.

Notes On Amplifier Power:
The important rating of an amp is RMS power. If this spec is not exaggerated, it is how many watts the amp can output continuously without distortion. Other specs (“peak” ; “maximum”) are not very meaningful in most cases. How does this match a subwoofer’s power rating? Read on...

Notes On Subwoofer Limits:
Subs have two limitations: **mechanical** and **thermal**. Crossfire combines these into the ratings explained at the top.

Thermal power handling of the woofer is basically how many watts you can pump into it before it burns or melts:
-Amps’ RMS power similar to the subwoofers rating should a good match providing the amp is not clipped
-Amp’s RMS power much more than subwoofers rating: could damage the sub unless gains are carefully set to prevent the amplifiers ever clipping.
-Amp’s RMS power much less than the subwoofers rating: could still damage the sub if the amp is clipped.

Mechanical power handling means how far the cone can move before physical parts hit or deform (“bottoming out”). At very low frequencies, it does not take much power to move the subwoofer cone a lot, so even low powered amplifiers could damage the subwoofer. The enclosure affects how easy it is to hit the mechanical limits: please see notes on a later page.

***Amplifier Clipping and Dead Subwoofers:**
When “Clipped” the amplifier tries to put out more power than it is capable of, and the output waveform flattens out, no longer following the music. Viewed on an oscilloscope, it looks like the music waveform has had the tops “clipped off” with scissors. Under these conditions, an amplifiers could put out over twice it’s rated RMS power, causing a subwoofer to overheat. Additionally, a clipped amplifier can generate DC currents which will drive the subwoofers coil out of position: it may burn and/or hit mechanical limits more easily. A clipping amp will sound highly distorted and crackly. A sub hitting it’s mechanical limits tends to sound like a jackhammer or woodpecker. These sounds often indicate damage could be imminent.

- Bottom line? If it sounds not merely loud but nasty, TURN IT DOWN before something breaks!

SPECS AND DIMENSIONS

MODEL:	C5 8D2	C5 8D4	C5 10D2	C5 10D4
Nominal Size	8"	8"	10"	10"
Outer Diameter (OD)	8.58" / 218mm	8.58" / 218mm	10.9" / 277mm	10.9" / 277mm
Inner Diameter (ID)	7.48" / 190mm	7.48" / 190mm	9.3" / 236mm	9.3" / 236mm
Mounting Depth (MD)	4.2" / 107mm	4.2" / 107mm	5.5" / 141mm	5.5" / 141mm
Woofer Displacement	.041ft^3 / 1.16L	.041ft^3 / 1.16L	.065ft^3 / 1.84L	.065ft^3 / 1.84L
Power Handling, RMS	400 Watts	400 Watts	500 Watts	500 Watts
Power Handling, Max	800 Watts	800 Watts	1000 Watts	1000 Watts
Magnet Size	60 OZ	60 OZ	120 OZ	120 OZ
Voice Coil Size / Material	2" Copper | 4 Layer	2" Copper | 4 Layer	2.5" Copper | 4 Layer	2.5" Copper | 4 Layer
Nominal Impedance (Z)	Dual 2 Ω	Dual 4 Ω	Dual 2 Ω	Dual 4 Ω
D.C.Resistance (Re)	1Ω (Paralleled)	1.6Ω (Paralleled)	1Ω (Paralleled)	1.6Ω (Paralleled)
Resonance Frequency (Fs)	42Hz	43Hz	30Hz	32Hz
Total Q (Qts)	0.31	0.37	0.43	0.48
Mechanical Q (Qms)	4.11	4.5	3.43	3.60
Electrical Q (Qes)	0.33	0.40	0.49	0.56
Stiffness (Vas)	0.3ft^3 / 8.5L	0.3ft^3 / 8.5L	1.34ft^3 / 38L	1.34ft^3 / 38L
Excursion (Xmax)	0.83" / 21mm pk-pk	0.83" / 21mm pk-pk	0.83" / 21mm pk-pk	0.83" / 21mm pk-pk
Cone Area (Sd)	29.3in^2 / 189cm^2	29.3in^2 / 189cm^2	56.3in^2 / 363cm^2	56.3in^2 / 363cm^2

Thiele-Small Parameters: these vary from unit to unit and also according to measurement technique, so don't get too hung up on exactness of the numbers or box design results. By the way, "pk-pk" means peak-to-peak.
Sensitivity (No): This spec is omitted because it is for mid frequencies and misleading for subwoofers.
Woofer Displacement Volume: For standard drop in mounting, please subtract the subwoofer's displacement volume from the gross enclosure volume to calculate accurate net enclosure volume.

Vance Dickason's Loudspeaker Cookbook contains tons of useful information and we highly recommended it

SPECS AND DIMENSIONS

MODEL:	C5 12D2	C5 12D4	C5 15D2	C5 15D4
Nominal Size	12"	12"	15"	15"
Outer Diameter (OD)	12.75" / 324mm	12.75" / 324mm	15.35" / 390mm	15.35" / 390mm
Inner Diameter (ID)	11.22" / 285mm	11.22" / 285mm	13.98" / 355mm	13.98" / 355mm
Mounting Depth (MD)	5.94" / 151mm	5.94" / 151mm	6.85" / 174mm	6.85" / 174mm
Woofer Displacement	.07ft^3 / 1.98L	.07ft^3 / 1.98L	.165ft^3 / 4.66L	.165ft^3 / 4.66L
Power Handling, RMS	500 Watts	500 Watts	600 Watts	600 Watts
Power Handling, Max	100 Watts	100 Watts	1200 Watts	1200 Watts
Magnet Size	120 OZ	120 OZ	120 OZ	120 OZ
Voice Coil Size / Material	2.5" Copper | 4 Layer	2.5" Copper | 4 Layer	2.5" Copper | 4 Layer	2.5" Copper | 4 Layer
Nominal Impedance (Z)	Dual 2 Ω	Dual 4 Ω	Dual 2 Ω	Dual 4 Ω
D.C.Resistance (Re)	1Ω (Paralleled)	1.6Ω (Paralleled)	1Ω (Paralleled)	1.6Ω (Paralleled)
Resonance Frequency (Fs)	29 Hz	30 Hz	30 Hz	31 Hz
Total Q (Qts)	0.44	0.45	0.54	0.47
Mechanical Q (Qms)	3.14	3.20	5.66	4.32
Electrical Q (Qes)	0.51	0.51	0.6	0.53
Stiffness (Vas)	2.4ft^3 / 68L	2.4ft^3 / 68L	3.36ft^3 / 95L	3.36ft^3 / 95L
Excursion (Xmax)	0.83" / 21mm pk-pk	0.83" / 21mm pk-pk	0.98" / 25mm pk-pk	0.98" / 25mm pk-pk
Cone Area (Sd)	81.1in^2 / 523cm^2	81.1in^2 / 523cm^2	126.2in^2 / 814cm^2	126.2in^2 / 814cm^2

BOX DESIGN NOTES

Sealed Boxes VS Ported Boxes:
Sealed Boxes offer the most protection from mechanical damage, plus can offer the most accurate sound quality if not undersized. Exact size is not too critical and can be adjusted by stuffing (see below). Response decreases gradually at low frequencies giving a nearly flat frequency response in many vehicles. But, there's no path for heat to escape from the box (one reason for mounting "inside out")

Ported (Vented) Boxes do offer some heat ventilation. Sound quality is less accurate, but often more powerful. The trade-off: more powerful sound is often boomier. At frequencies below the port tuning, the enclosure does not restrict cone motion. Therefore, music with very low frequencies can bottom out the subwoofer, possibly causing damage. Also, the frequency response rolls off quickly, because the port stops functioning like a port and becomes more like a huge leak-the front and back waves from the subwoofer start to simply cancel each other. If possible, build the box so you can do test listening before final assembly. You can then adjust the port length to taste. If it sounds too boomy after final assembly, you can experiment with stuffing, but not near the port or cone or magnet vents.

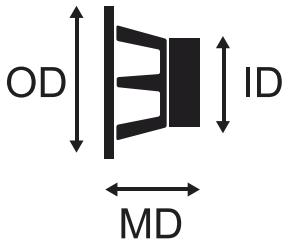
Box Stuffing: Dense stuffing changes the thermal properties of the enclosure, and can make the enclosure act larger than the measured dimensions. This means sealed boxes can be made somewhat smaller with the same sound. For example, stuffing with 1 pound (1/2 kilo) of 100% polyester such as pillow stuffing could let you shrink the sealed box 15% but keep basically the same sound. Ported boxes cannot take advantage of this effect very well, since stuffing the enclosure can negatively affect the air flow in and out of the port. Coating the inside walls with anti-vibration compounds or sheeting can improve the sound as can bracing the enclosure.

Ports: Air in the box resists compression, like a spring. The port basically makes a plug of air, with a certain mass. The system resonates, kinda like how a car bounces up and down on its springs. A longer port has more mass, lowering the tuning. A bigger port also has more mass, but the larger area changes how much box stiffness the port "sees" and tuning goes up. To compensate, the port can be lengthened, but the port needs to be big enough to match the cone excursion. Unfortunately for auto sound buffs, this all means that a round port big enough to flow all the air often can't fit in the box! And, ports should NOT be built with elbows if at all possible, it kills the airflow.

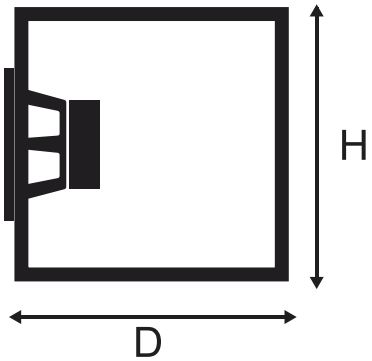
Port Radius: Rounding the port ends reduces distortion at lower volumes. At high SPL, the air just "jets" in and out and the radiusing has little effect. (For slot ports, the shape is different, so do radius the inside end if you can).

Crossfire recommends the use of Precision Ports™ for all round port applications. Precision Ports™ will increase SPL and reduce airflow turbulence at the entrance and exit of the port with its unique flare port design.

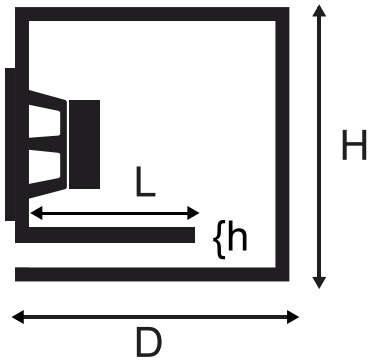
Sub Dimensions



Sealed Box



Ported Box



RECOMENDED SEALED ENCLOSURES

MODEL:	C5 8D2	C5 8D4	C5 10D2	C5 10D4
Internal Volume (Net)	0.35ft^3	0.35ft^3	0.6ft^3	0.6ft^3

MODEL:	C5 12D2	C5 12D4	C5 15D2	C5 15D4
Internal Volume (Net)	1.1ft^3	1.1ft^3	2.0ft^3	2.0ft^3

RECOMENDED PORTED ENCLOSURES

MODEL:	C5 8D2	C5 8D4	C5 10D2	C5 10D4
Internal Volume (Net)	0.65ft^3	0.65ft^3	1.25ft^3	1.25ft^3
Port Tuning Frequency	38Hz	38Hz	32Hz	32Hz
Port Area	7 sq inch / 3” Round	7 sq inch / 3” Round	7 sq inch / 3” Round	7 sq inch / 3” Round
Port Length	16.75”	16.75”	12.5”	12.5”

MODEL:	C5 12D2	C5 12D4	C5 15D2	C5 15D4
Internal Volume (Net)	2.0ft^3	2.0ft^3	3.0ft^3	3.0ft^3
Port Tuning Frequency	32Hz	32Hz	34Hz	34Hz
Port Area	12.5 sq inch / 4” Round	12.5 sq inch / 4” Round	28 sq inch / 6” Round	28 sq inch / 6” Round
Port Length	13.5”	13.5”	17.5”	17.5”

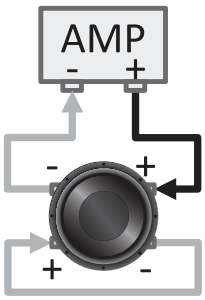
Please Note: All enclosure recommendations are based on net enclosure volume. Please add woofer displacement and port displacement to calculate accurate net enclosure volume. Example: C5 12D4 has a woofer displacement of .07ft3 and a port displacement of .098ft3, So your ported enclosure needs to be 2.2 ft3 gross volume before all displacements, giving you a net volume 2.0ft3.

These recomended enclosures are general enclosure recomendations and can be varied to suit each customers application. For SPL type applications, enclosure volumes and tuning frequencies will vary for each application. For custom enclosure applications please contact Crossfire Technical Service Dept.

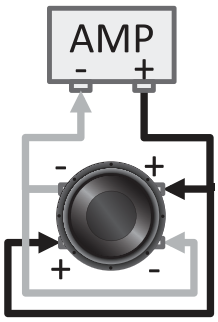
DUAL VOICE COIL WIRING OPTIONS

Speaker Wiring Comments: For each individual subwoofer, it doesn't matter if you wire the coils in series or parallel. However, don't wire in series with another subwoofer - that results in less than optimum power sharing and sound. Likewise, don't wire just one coil of a dual coil setup. For single coil subs, ignore the bottom wire in the diagrams below.

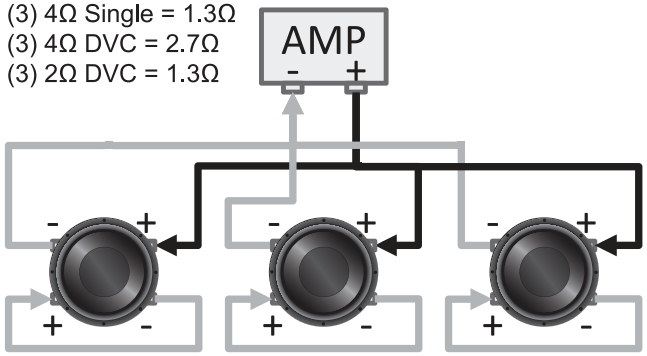
1 Sub-Series
4Ω DVC = 8Ω
2Ω DVC = 4Ω



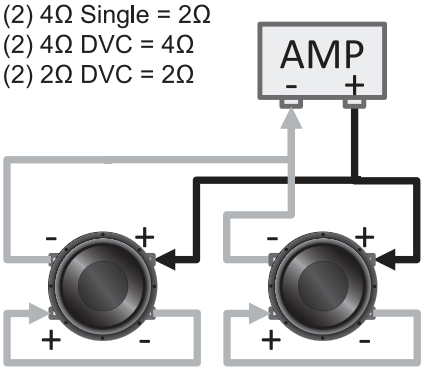
1 Sub-Parallel
4Ω DVC = 2Ω
2Ω DVC = 1Ω



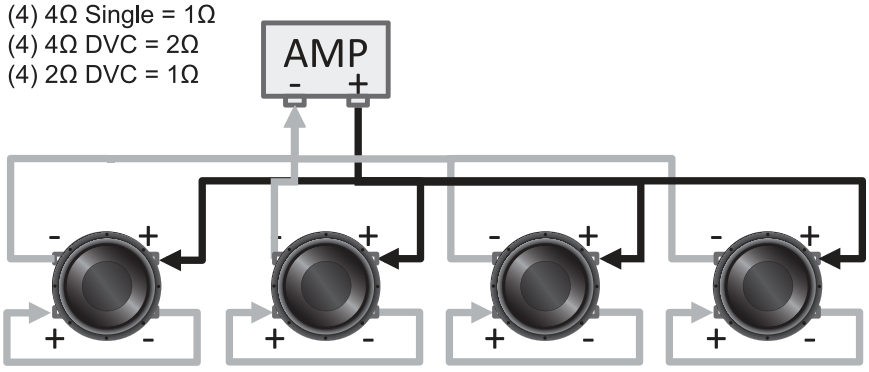
3 Subs in Parallel
(Each DVC wired in series)
(3) 4Ω Single = 1.3Ω
(3) 4Ω DVC = 2.7Ω
(3) 2Ω DVC = 1.3Ω



2 Subs in Parallel
(Each DVC wired in series)
(2) 4Ω Single = 2Ω
(2) 4Ω DVC = 4Ω
(2) 2Ω DVC = 2Ω



4 Subs in Parallel
(Each DVC wired in series)
(4) 4Ω Single = 1Ω
(4) 4Ω DVC = 2Ω
(4) 2Ω DVC = 1Ω



LIMITED WARRANTY

LENGTH OF WARRANTY
Crossfire Subwoofers are covered by warranty for 1 year from date of purchase on parts and labor. This applies to the original purchaser only. Warranties are non-transferable.

DETAILS OF WARRANTY
From the date of original purchase and for the respective period, specified above.
Crossfire agrees to repair or replace all Crossfire products which are defective in materia1 and/or workmanship. This warranty is not transferable and applies only to the original purchaser of the product. No Exceptions. It is Crossfire's right to decide if a product will be repaired or replaced.

All returns must be sent with an RA # on the outside of the box. Any and all products sent without an RA# will be refused. An RA # can be obtained by calling or faxing Crossfire and requesting the number.

Warranty claims must be accompanied by the original invoice to validate the warranty service.

EXCLUSIONS
This warranty does not apply with respect to the following:

- Crossfire's warranty does not cover burned or open voice coils, lead wires, ripped surrounds or folded cones. These are all immediate signs of abuse and over-powering. It does not cover products driven over their mechanical limits.
- Defects or damage caused by accident, fire, flood, and lightning or other acts of God.
- Defects or damage caused by abuse, misuse, or negligence.
- Products with voice coils that have failed due to excessive power levels or clipping, i.e. burned or open voice coils or burned lead wires.
- Damage caused during shipping or handling. These claims are made with the Freight Company.
- Accessories or anything else attached to or to be used with Crossfire products.
- Products that have their serial numbers removed or altered.
- Packing materials i.e. card board boxes, foam inserts, corners, peanuts, etc.
- Adjustments or alterations required for any reason.
- Items subject to fatigue through normal wear and use.
- Products, which has been altered or repaired by anyone other than Crossfire.

RE-CONES
All subwoofers that have been re-coned by Crossfire will continue under warranty until the full 1 year warranty has expired. Any re-cone not performed at Crossfire by an authorized Crossfire employee is not covered under warranty. The end consumer accepts the responsibility and liability of knowing this subwoofer no longer falls under Crossfire's warranty program when the re-cone they purchased and/or the labor was performed by the end consumer.

3247 Story Rd West, Irving TX 75038
Ph: (972) 570-0800 | Fax: (972) 570-2200
www.crossfirecaraudio.com